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equation obtained from (1) for $z'=d$, whose second degree terms, being those of (1) not containing z' , are the same: $B^2(x'-k)^2 - y^2 = l^2$. Thus the asymptotes $y = \pm B(x'-k)$, $z'=d$ are parallel to the first lines $y = \pm Bx'$, $z'=0$.

Also solved by S. G. Barton and V. M. Spunar.

MECHANICS.

249. Proposed by the late G. B. M. ZERR, Ph. D.

A load P is supported by three strings of equal size attached at the vertices of a triangle, sides a, b, c lying in a horizontal plane. The load is vertically under the centroid of the triangle at a distance h from it. Find the stresses in the strings.

Solution by the PROPOSER.

Let h_1, h_2, h_3 be the medians of the triangle; T_1, T_2, T_3 the stresses on the strings attached to A, B, C , respectively; D , the point where the load is fixed; G , the centroid; H , the mid-point of BC .

$$\angle ADG = \theta, \angle BDG = \phi, \angle CDG = \psi, \angle BGH = \rho, \angle CGH = \mu.$$

$$p = \cos \theta = 3h/\sqrt{(9h^2 + 4h_1^2)} = 3h/\sqrt{(9h^2 + 2b^2 + 2c^2 - a^2)}.$$

$$q = \cos \phi = 3h/\sqrt{(9h^2 + 2a^2 + 2c^2 - b^2)}.$$

$$r = \cos \psi = 3h/\sqrt{(9h^2 + 2a^2 + 2b^2 - c^2)}.$$

$$m = \sin \phi \sin \rho = 3ab \sin C / \sqrt{(9h^2 + 2a^2 + 2c^2 - b^2)(2b^2 + 2c^2 - a^2)}.$$

$$n = \sin \psi \sin \mu = 3ac \sin C / \sqrt{(9h^2 + 2a^2 + 2b^2 - c^2)(2b^2 + 2c^2 - a^2)}.$$

Let E = Young's modulus, β = sectional area of string, p_1 = elongation AD , p_2 = elongation BD , p_3 = elongation CD . Then

$$P = pT_1 + qT_2 + rT_3 \dots (1),$$

$$mT_2 = nT_3 \dots (2),$$

$$T_1 p_1 + T_2 p_2 + T_3 p_3 = \text{minimum}.$$

$$\text{Now } p_1 = \frac{AD \cdot T_1}{E\beta}, \quad p_2 = \frac{BD \cdot T_2}{E\beta}, \quad p_3 = \frac{CD \cdot T_3}{E\beta}.$$

$$AD \cdot p = BD \cdot q = CD \cdot r = h.$$

$$\text{Hence, } \frac{h}{E\beta} \left(\frac{T_1^2}{p} + \frac{T_2^2}{q} + \frac{T_3^2}{r} \right) = \text{minimum} \dots (3).$$

From (1), (2) and (3) we get

$$pdT_1 + qdT_2 + rdT_3 = 0 \dots (4),$$

$$mdT_2 = ndT_3 \dots (5),$$

$$T_1 dT_1/p + T_2 dT_2/q + T_3 dT_3/r = 0 \dots (6).$$

Eliminating dT_1 , dT_2 , dT_3 between (4), (5) and (6), we get

$$T_1(qn + rm)qr = T_2p^2m + T_3p^2qm \dots (7).$$

From (1), (2) and (7) we get

$$T_1 = \frac{Pp^2(rn^2 + qm^2)}{p^3(rn^2 + qm^2) + qr(qn + rm)}.$$

$$T_2 = \frac{Pqrm(qn + rm)}{p^3(rn^2 + qm^2) + qr(qn + rm)}.$$

$$T_3 = \frac{Pqrm(qn + rm)}{p^3(rn^2 + qm^2) + qr(qn + rm)}.$$

ERRATA.—Begin with problem 240. Mechanics, page 194, Vol. XVI, and number them consecutively through Vol. XVII. Problem 247 in the last issue should be 248. Note that 244 on page 48, Vol. XVII is the same as 241, page 21.

250. Proposed by C. N. SCHMALL, New York City.

A smooth circular table is surrounded by a smooth vertical rim. A ball of elasticity e is projected from a point at the rim in a line making an angle ϕ with the radius through that point. Show that the ball will return to the starting point after the second impact if

$$\tan \phi = \sqrt{\frac{e^3}{e^2 + e + 1}}.$$

Solution by the late G. B. M. ZERR, Ph. D.

Let A be the point of projection; B , C the points of first and second impact; O , the center of the table; $\angle OAB = \angle OBA = \phi$, $\angle OBC = \angle OCB = \theta$, $\angle OCA = \angle OAC = \psi$.

Then $\tan \phi = e \tan \theta$, $\tan \theta = e \tan \psi$.

Hence, $\tan \phi = e \tan \theta = e^2 \tan \psi$. Also, $\phi + \theta + \psi = \frac{1}{2} \pi$.

$\therefore 1 = \tan \phi \tan \theta + \tan \phi \tan \psi + \tan \theta \tan \psi$. Whence

$$1 = \tan^2 \phi \left(\frac{1}{e} + \frac{1}{e^2} + \frac{1}{e^3} \right).$$